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ALGONQUIN PARK

Spruce Bog Boardwalk

Algonquin Spruce Bog Ecology

Spruce Bog Boardwalk

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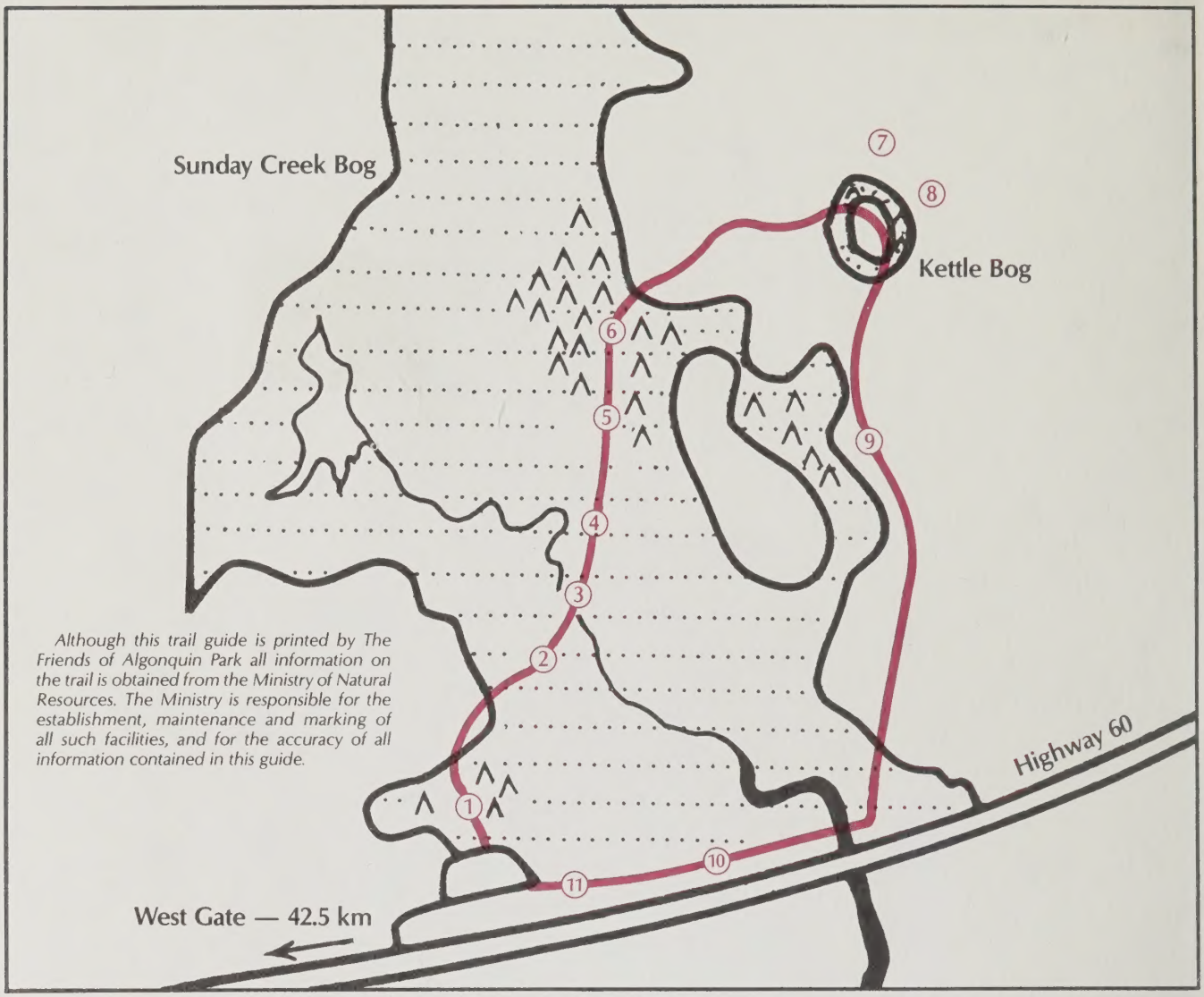
Drawings by Howard Coneybeare



The Spruce Bog Boardwalk is a 1.5 km loop which will take you across two separate bogs, the Sunday Creek Bog and a small kettle bog. About half the trail is on boardwalk, enabling you to see at close range the little known world of a spruce bog.

The numbered sections of this guide correspond to numbered posts along the trail, and offer some insight into the history and ecology of Algonquin Park spruce bogs. Please stay on the trail at all times and do not pick any plants.

The Ministry of Natural Resources wishes to thank Dr. Jan Terasmae and Dr. Matti Saarnisto for their invaluable help in coring the bogs on this trail and in interpreting their history.

Post 1 A Waterlogged Desert

You have now entered a spruce bog — a strange world of spindly Black Spruce and lush green carpets of moss. As the map shows, you are actually in just a small arm of the very large Sunday Creek bog which you will cross farther along the trail.

But just what are bogs anyway, and what is so special about them? Perhaps the best way to explain bogs is to go back to their beginnings. In Algonquin Park all bogs started as open water — small lakes, or sheltered bays of large lakes left when the glacier melted back 11,000 years ago, or as beaver ponds formed since then. In the

centuries which followed, what was originally open water has been invaded and covered from the edges by a mat of floating sedges, mosses and shrubs. Generations of plants grew and died there and then sank down into the mat. From time to time pieces of semi-decayed plant remains detached from the bottom of the floating mat, drifted down to the bottom of the lake,

and accumulated there as layers of peat. Where the water was shallow enough, the peat layers eventually built right up to the mat and grounded it. At this point or even earlier, the mat was invaded by Tamarack and then Black Spruce trees, completing the transformation of the original lake into a forest.

The story of a bog, therefore, is that of an orderly succession of plants and animals which brings about this remarkable change. The process is even more striking for the fact that, in all its stages, the bog water is distinctly acidic, contains almost no oxygen, and has very few dissolved salts and minerals. (As every gardener knows, vital nutrients such as calcium, nitrogen, and phosphorus are required by all plants — not to mention us humans and all other animals as well.) The chemical conditions of a bog impose severe restrictions on the kinds of plants that grow there and how well they can grow. This bog may be green and saturated with water like a giant sponge but, to the plants which grow here, the lack of nutrients almost makes it a desert.

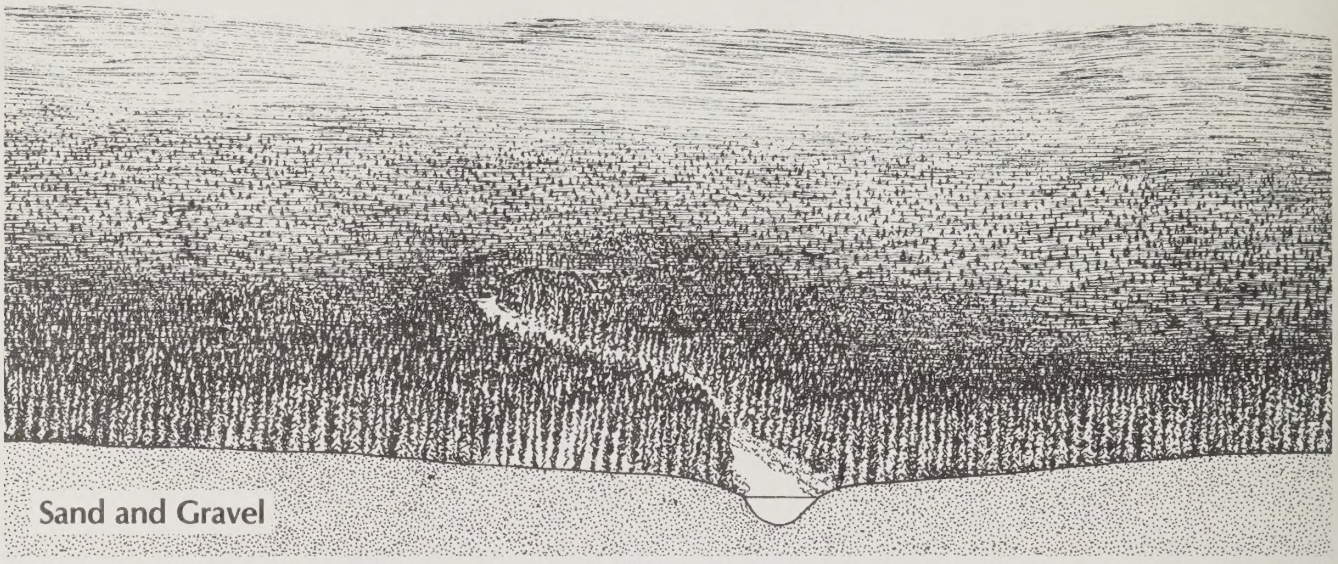
For one reason or another, not all bogs in Algonquin Park (or parts of the same bog) have developed to the advanced forest stage you see here. Farther up the trail, for example, you will see treeless parts of this same bog which probably look the way the area here at Post 1 did several thousand years ago.

Post 2 Tales From Beneath Your Feet

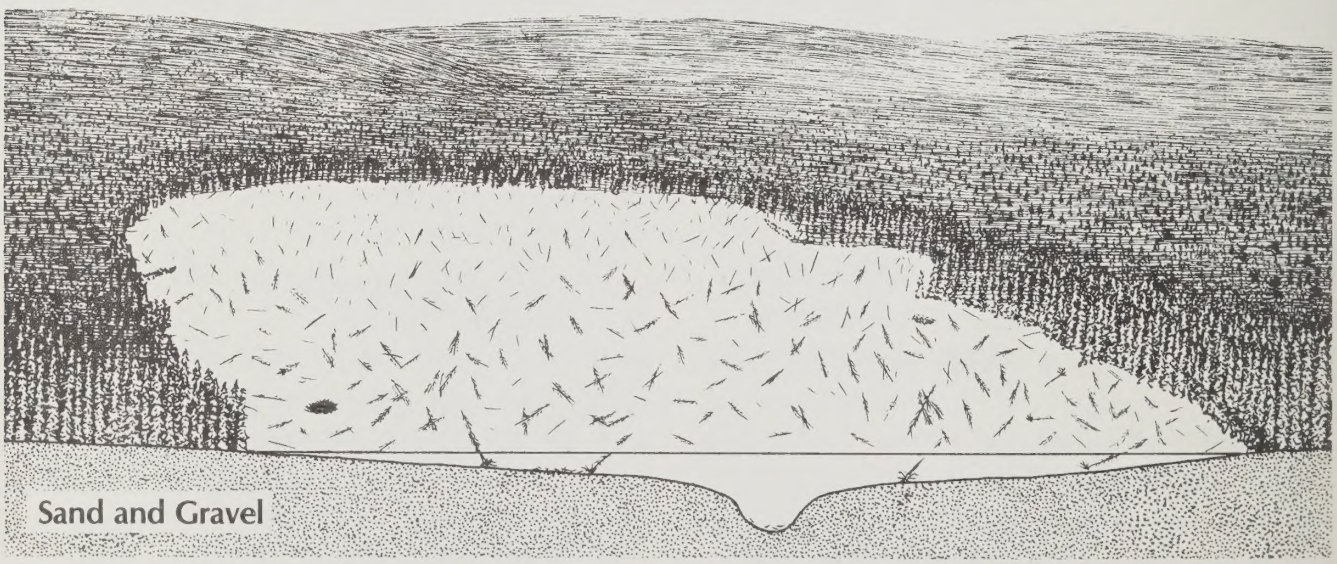
Normally we would be at quite a loss to tell you just how and when this bog got started. As we mentioned at the last post, however, two of the main features of a bog are the almost total lack of oxygen and the acidic nature of the water. Both these features mean that conditions are very poor for the bacteria which cause decay — with the result that the peat layers below you contain leaves, pollen grains, and fragments of wood which are often almost perfectly preserved even though many of them are thousands of years old.

By using a special coring tool, scientists have withdrawn samples of peat from various places in the bog. Examination of the preserved plant remains and dating them through measurements of the radioactive carbon they still contain, have enabled us to piece together the following important details of the bog's history.

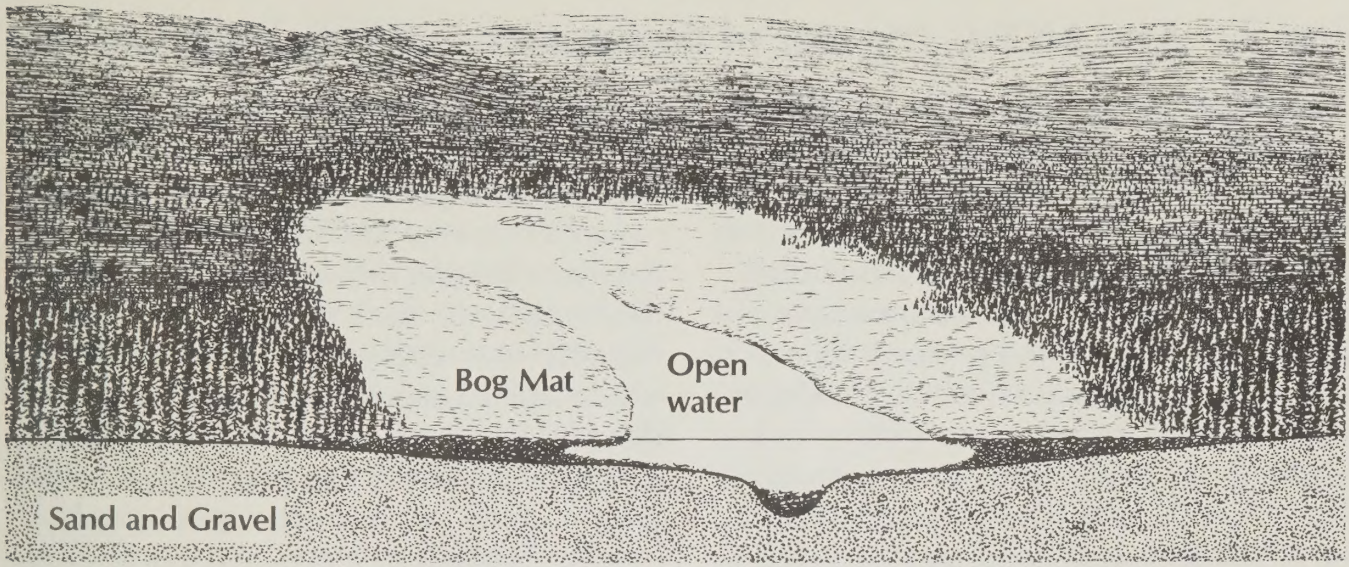
When the last glacier melted back from Algonquin Park 11,000 years ago, tremendous volumes of water were released and poured through the valley now occupied by this bog. The water carried a great deal of sand from rock which had been ground up and trapped inside the glacier. Much of the sand settled out from the river so that when the water finally subsided this valley was occupied by a flat sand plain with a small creek flowing through it. Over the next several hundred years the sand plain, now 2 metres below you, was invaded by plants following the northward retreat of the glacier. Eventually a forest of pine and



1. Cross section of Sunday Creek as it was 8000 years ago — a stream through the forest



2. Cross section of Sunday Creek as it was after beavers dammed it 7400 years ago

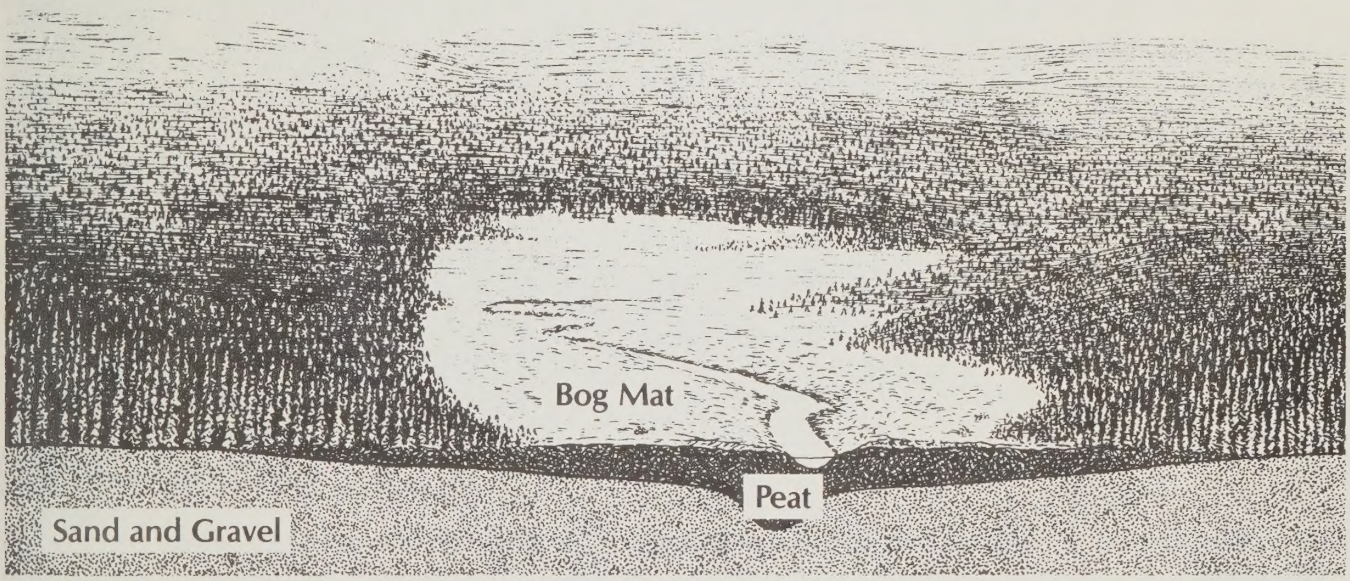


3. Cross section showing how the floating mats advanced from each side towards the centre of the flooded valley

spruce became established on the plain and this situation lasted for at least 1,000 years.

All this changed 7,400 years ago when the plain was flooded, almost certainly by beavers damming the stream. The flooding killed the trees which eventually fell and sank to the bottom of the beaver pond. (They lie there to this day on the sandy bottom — but buried under the two metres of peat beneath you.)

The beavers thus transformed a forest into a shallow lake and created the conditions which have led to the formation of the bog you are standing on. At first, water lilies and other aquatic plants grew rooted in the bottom of the pond. Then, two floating mats of bog vegetation spread inward from both shores, until almost the whole water surface was covered about 400 years later. Because the original pond was so shallow, it was soon filled in by dead plants settling to the bottom from the floating mats. In other words, only the inner or leading edges of the mat were actually floating on water — the older portions of the mat soon came to rest on a solid layer of peat.



4. Cross section of Sunday Creek today. Peat has filled in the space below the two mats.

If this bog had been left completely on its own it would long ago have been occupied by Black Spruce and turned into a forest like the one you saw at Post #1. However, beavers are still present, and from time to time they have dammed the creek channel between the bog mats. Even a slight rise in the water level is sufficient to kill the spruce and keep the bog largely clear of trees.

Post 3 And NOW, the star of the show . . . *Carex lasiocarpa!!*

Now that you know the basic plot in the story of an Algonquin bog, it is time to get to know some of the individual actors. Here, residing at the edges of the creek, is the star of the show. Although it is in plain view you may be excused for not immediately recognizing the supreme importance of the little sedge which is growing in grass-like clumps at the water's edge. As a matter of fact this sedge is so unspectacular that it doesn't really have a name besides the Latin, *Carex lasiocarpa,* and yet it truly is the most important plant in the bog. Without it, the bog would simply not be here. None of this vast expanse of bog would ever have developed without *Carex lasiocarpa* to lead the way.

The special feature of the *Carex lasiocarpa* sedge is that its rootstocks do not have to be buried in mud, but can and do grow out into open water. The floating network of *lasiocarpa* rootstocks form the leading edge of the floating mat in which all the other plants of the mat take root. When the beavers first flooded this valley 7,400 years ago, *Carex lasiocarpa* colonized the edges of the pond and began the long process of bog mat formation which has covered and filled in almost the entire pond. As we mentioned before, there were actually two mats, one growing from each side of the pond in toward the centre. As the two mats approached each other they reduced the amount of space available for the water flowing through the pond and so the current was made stronger. Eventually the point was reached where the current was strong enough (in the spring run-off) to tear pieces away from the relatively delicate leading edges of the two mats. The inward growth of the two mat edges was halted long ago and in fact not even the edges are floating now — the space underneath them has filled in with peat.

The weakness of the floating mat of sedge rootstocks, incidentally, is the reason bogs have not formed over swiftly flowing rivers or large lakes. The edge of the mat is easily broken up by currents, waves, or ice action, so it is only on sheltered bodies of water with little water flow that *Carex lasiocarpa* can do its thing.

It is interesting to note that *lasiocarpa* grows at the edges of the bog mat, but not back in the older parts. The little sedge may be the all important pioneer in bog formation but once it has created a mat, other plants take root and crowd out their benefactor.

Carex lasiocarpa **advancing (to the left) at the leading edge of the mat over open water**

Post 4 An Exclusive Association

To your right is an expanse of open bog. There are two kinds of plants which account for nearly all the vegetation you see here — the densely growing shrub leatherleaf, and the carpet of green sphagnum moss growing beneath the leatherleaf. (There are actually many different kinds of sphagnum moss, but they are so difficult to identify that most people are content to call them simply sphagnum or peat moss and let it go at that.)

Sphagnum and leatherleaf form a rather exclusive association, for there are very few other plants which can grow under the extremely difficult conditions found here. Not only is the water acidic and almost totally devoid of oxygen, but the water just sits there completely saturating the bog — so that no new water, carrying nutrients, can flow into it. This is extremely important because you will remember that the "ground" here contains no mineral soil. It is formed entirely from the peaty remains of previous generations of bog mat plants. To make matters even worse, the few minerals which the peat does contain are largely unavailable to new generations of plants because the dead plants in the peat break down very slowly or not at all.

No one would ever expect to get an adequate supply of such important nutrients as nitrogen and calcium (needed by all living things for the production of proteins and cell walls) from a diet of rainwater. Yet the plants growing in the bog require these substances just as we do and about the only source they have is in fact rainwater. The fact that anything grows here at all is something of a miracle and nobody should be surprised that it took several centuries for the mat to form in the first place.

If you look to your left, on the other side of the boardwalk, you will see that the vegetation is rather different closer to the creek. Here shrubs such as Sweet Gale and Speckled Alder have been able to get established because the creek water is less acid and carries in some nutrients washed down from the mineral soils of the surrounding hills.

Leatherleaf

Sweet Gale

Speckled Alder

Post 5 The Army Advances and Retreats

You are now entering a part of the bog occupied by a forest of spindly Black Spruce trees. This area is a bit drier than the open bog, partly because it is closer to the original shore of the open water. The bog mat reached here sooner and therefore, has had more time to develop and become more solid. More important, however, is the fact that this treed part of the bog is farther from the creek and is therefore less likely to be affected by the periodic dam building of beavers. In some bogs the army of spruce advances right out to the edge of the mat, but here, because of the beavers, the army has no doubt advanced and retreated many times.

If the invasion of the bog has been something less than a complete success, the Black Spruce is nonetheless a very interesting and important tree. It may not be your idea of a beautiful tree, but you have to give it full marks for doing as well as it does in an extremely hostile environment. Like the plants of the open bog mat, the Black Spruce grows in an acidic, nutrient-starved base of organic matter. As a result it grows very slowly (even the small trees here are over 30 years old), but it does grow. Because it has so little to work with, it is not surprising that the Black Spruce is adapted to make the most of what it has. It cannot afford to manufacture strong spreading branches, but the small, slender branches it does have at least slope downward so that they can bend with the weight of snow in winter without breaking off.

The Black Spruce is also an evergreen. Since the leaves contain precious nutrients, it pays the Black Spruce to hang on to each needle for several years. Nutrients are so rare in a bog, and hard for plants to absorb because of the acid water, that even many of the bog shrubs keep their leaves year round. We don't normally think of shrubs as being evergreen, but in a bog, being evergreen is a distinct advantage even for a shrub whose leaves are completely covered by snow in winter.

In Algonquin Park the Black Spruce is mostly found in bogs, but to the north it grows on solid land as well, and covers thousands of square miles in almost pure stands. It is these vast forests of Black Spruce which serve as the base of Canada's pulp and paper industry, still the country's biggest, and by far and away the leading earner of foreign exchange.

Post 6 Water, water, everywhere and not a drop to drink

The shrub growing in the sphagnum moss at this post is called Labrador Tea. (A kind of tea can be made from its leaves, but most people would rather walk a mile for the imported variety.) Whatever their shortcomings as tea leaves, the leaves of this shrub are still rather special. You will notice that the edges are curled over and the lower surface is covered with a thick layer of white or orange down. If you were to visit a desert, in Arizona for example, you would find that many plants growing in the dry desert soil had the same features. Indeed it is believed that the curled leaf edges and downy layer on the under surface (where the breathing pores are located) are both features which help desert plants to keep what little water they manage to get.

But why in the world should Labrador Tea, growing in one of the wettest environments imaginable, have these same water conserving features? At the last stop we saw that it was advantageous for many bog plants to be evergreen. (Every leaf contains precious nutrients which are hard to come by in the bog environment so it pays bog plants to keep their leaves as long as possible.) Labrador Tea is one of these evergreen bog plants — a fact which helps it survive in the nutrient-poor bog environment. But, if being evergreen helps Labrador Tea get around the nutrient problem, it also exposes the plant to another problem. In late fall and early spring, the roots of Labrador Tea are encased in ice but the leaves are not yet covered in snow. In other words the plant can't absorb any water through its roots but it can still lose water to the air through the breathing pores on its leaves. It is then that the Labrador Tea is well served by its peculiar leaves. As with the desert plants, the curled over edges and downy under-surface of the leaves reduce the water loss through the leaf pores to the dry air.

It is interesting to stop and think how finely adjusted Labrador Tea is to its rigorous bog environment.

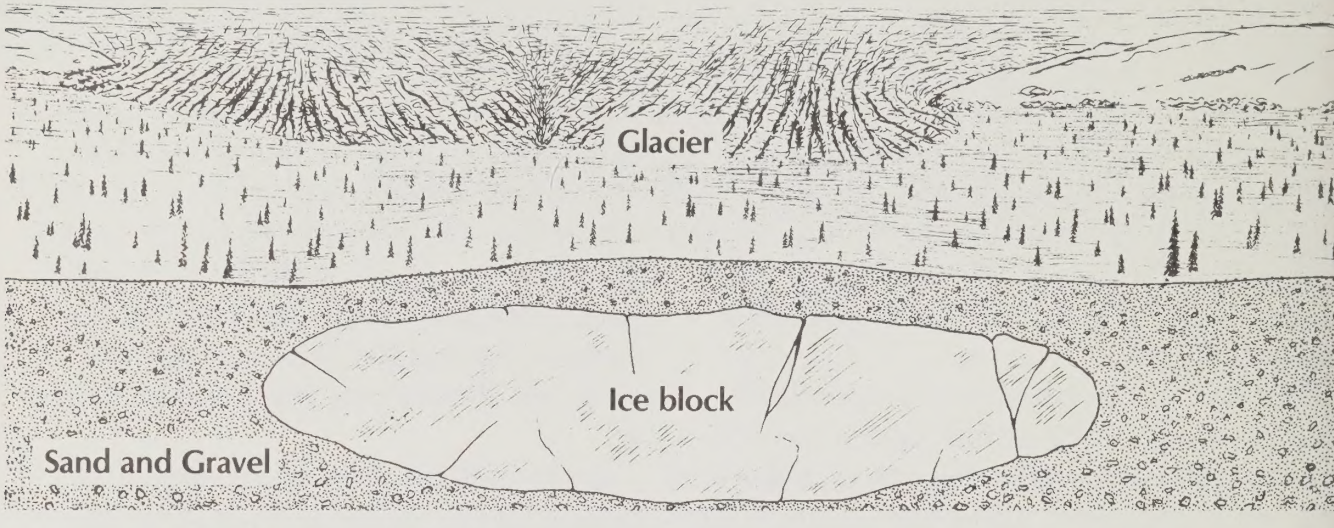
Labrador Tea

Post 7 An Ice Cube in the Kettle

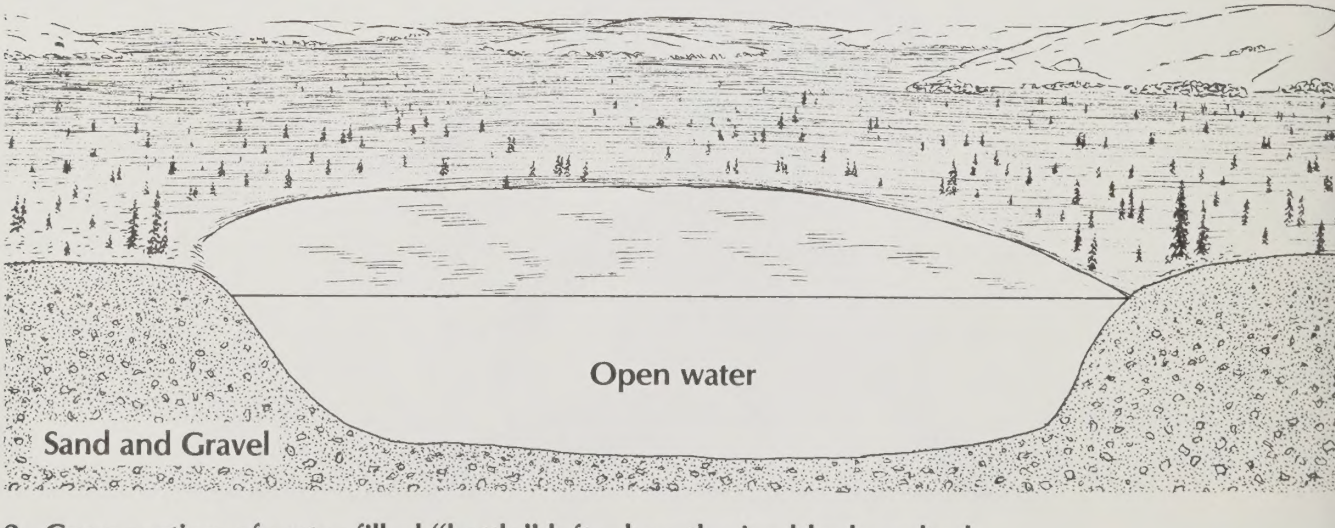
This new stretch of boardwalk has taken you into a second bog, completely separate from the Sunday Creek bog which you left at the end of the last boardwalk.

Unlike the Sunday Creek bog which owed its beginnings to beavers, this one got started thanks to a huge block of ice. When the glacier melted back 11,000 years ago, great pieces occasionally were left stranded as the main body of the glacier continued its retreat northward. Such stranded ice blocks were often surrounded or completely buried by sand and gravel released by the melting glacier. When the ice blocks themselves finally melted, they left small, but deep, water-filled holes in the sand or gravel landscape. These holes, called kettles, are quite common in Ontario, and if you had been around 11,000 years ago you would have had no trouble recognizing this bog-filled depression as a kettle lake.

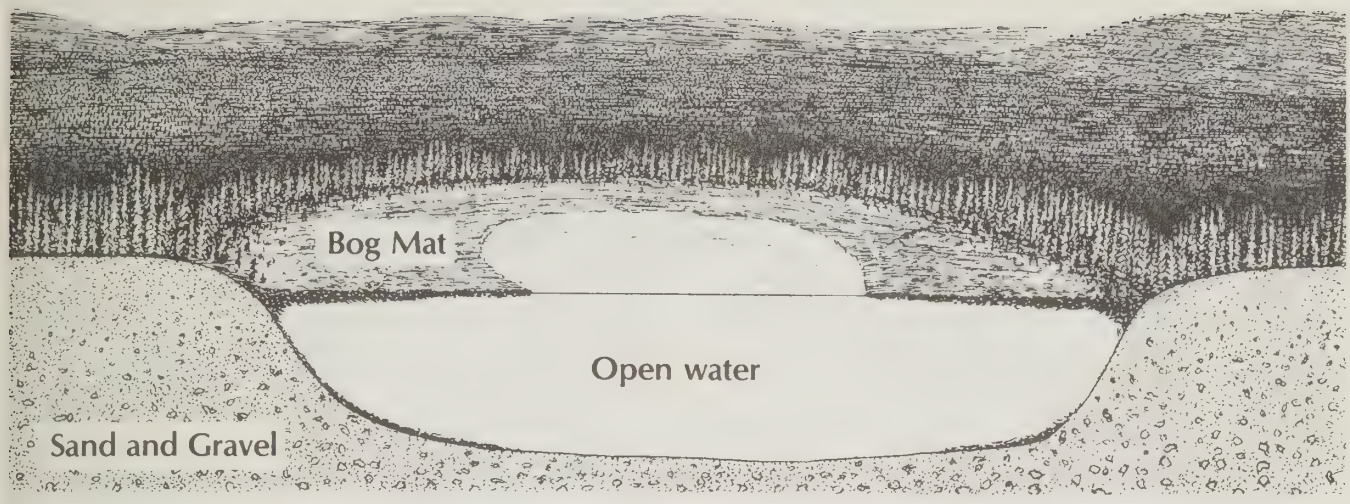
Today, there is no open water left here and Black Spruce trees have invaded 10 or 15 metres out from all around the edge of



1. Cross section of ice block stranded and buried in gravel 11,000 years ago



2. Cross section of water filled "kettle" left when the ice block melted

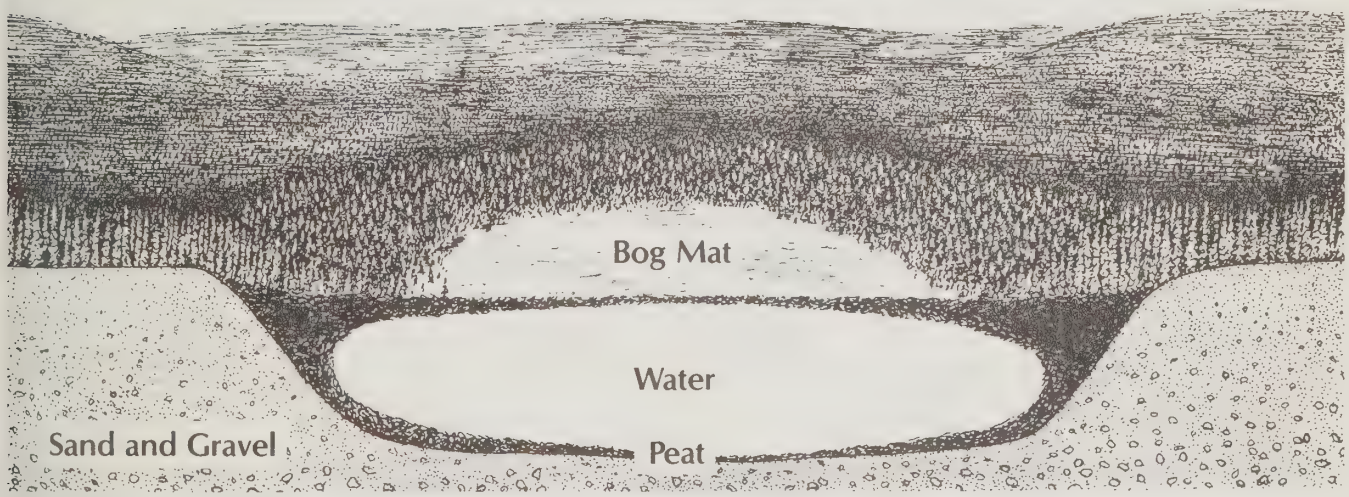


3. Cross section of kettle as bog mat advances from the edges over the open water.

the former lake. But just because the lake is no longer visible, it doesn't follow that the lake is completely gone. As a matter of fact, the central, open part of this bog is a mat floating over 9 metres of soupy brown bog

happens, the mat may become strong enough to support Black Spruce trees over the entire surface of what was once open water.

At the present time the mat is a relatively



4. Cross section of kettle bog as it appears today. The mat completely covers the water and trees have started to close in.

water. Coring this bog revealed that at the bottom there is about a metre of peat formed by dead sedges, mosses, and shrubs which settled down from the floating mat.

The original kettle was so deep, however, that it may take several thousand more years for this particular bog to be completely filled in with peat. Before that

thin layer with many weak spots. We strongly advise against walking on it because of the danger both to the fragile mat and to yourself. If by chance you did go through, your only consolation would be that your body would be preserved for thousands of years in the acidic, oxygen-poor peat 9 metres below.

Post 8 Be Quiet and Eat Your Bug

One of the most remarkable plants found in Algonquin Park typically grows in bogs like this one. Unfortunately you won't be able to see a Pitcher-plant here because they have all been picked by previous trail users — it only takes a tiny minority of inconsiderate people — and you will have to rely on the picture to see what the plant looks like.

The Pitcher-plant traps insects in its specialized, water-holding leaves

You will recall that one of the serious difficulties faced by plants growing in bogs is the lack of available nitrogen. Most plants get the nitrogen they need to manufacture proteins from chemicals called nitrates made by soil bacteria. Since bog mats contain so few of these nitrate-producing bacteria, plants growing in bogs like this one are up against a special problem indeed. Special problems require special solutions and the Pitcher-plant, along with several other bog plants, has solved the problem in a bizzare fashion. It traps insects, digests them and uses the proteins of its prey to make Pitcher-plant proteins.

Interestingly enough, there is one kind of insect that can beat the Pitcher-plant's system. A species of mosquito whose larvae are able to resist the pitcher's digestive enzymes, actually lays its eggs in the quiet, nutrient-rich haven of water contained in the Pitcher-plant leaves. Lest you think badly of the Pitcher-plant because of this, we hasten to say that this particular kind of mosquito does not bite humans.

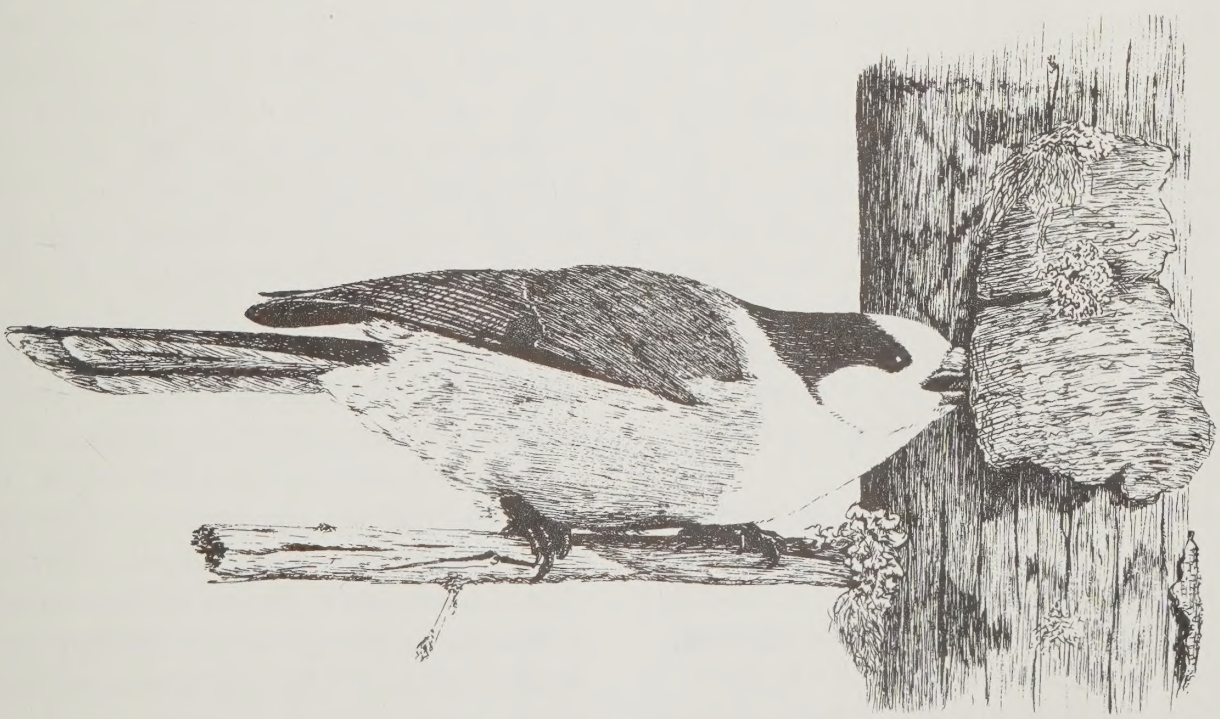
Post 9 One Problem; Three Solutions

Golden-crowned Kinglet

Standing on this rock you are overlooking a forested part of the first bog you visited on the trail. Needless to say, conditions now are very different from those prevailing when this was open water. Many creatures are able to live here thanks to the process begun thousands of years ago by the lowly sedge *Carex lasiocarpa*. You are probably walking this trail in the summer when there is an abundance of insects and fruit to provide food for birds and mammals. This doesn't mean for a minute, however, that conditions are always easy in the mature bog. It is too easy to forget that for almost half the year the temperature is below freezing and the bog plants are covered with as much as a metre of snow. How to get over this critical period when life stands still in the spruce bog is a problem which must be faced by all its inhabitants; otherwise starvation would be certain.

Among birds living in the bog, three different solutions have evolved. The most usual way out is that taken by the Golden-crowned Kinglet, the tiny insect hunter whose high pitched lisping call mingles with the sound of swaying spruce tops during June and July. The Kinglet and most other birds migrate south to milder climates so the problem of winter food supply in the bog is thus avoided. The Kinglet does pay a price, however, because over half the birds die each year during the dangerous trips to and from their winter quarters.

The most famous bird of the northern spruce forests is the Gray Jay, formerly called Canada Jay or sometimes Whiskey Jack. The Gray Jay can stay here all winter



Gray Jay storing food behind bark

and avoid the dangers of migration by relying on thousands of tiny food caches (insects, berries, mushrooms and small pieces of meat) built up over the summer and fall. Astoundingly, Gray Jays recover their stored food not by blind chance but through memory and thanks to this prodigious mental ability they coast through the winter with little difficulty. It does mean, however, that each pair of Gray Jays needs a large territory to find and store enough food. While the Kinglet requires only a hectare or two, the Jay needs over sixty. The Jay population is quite sparse, therefore and, since there is little room for newcomers, about 80% of all young birds die before they are one year old.

Spruce Grouse

There is only one obvious kind of green food available in a spruce bog in the winter — the needles of spruce trees. They have extremely low nutritive value but there actually is a bird that gets by during the cold, snowy months by eating them. This is the Spruce Grouse, a northern species rarely found south of Algonquin and often the object of special trips to the Park by southern naturalists wishing to observe it. This trail, as a matter of fact, is one of the most famous places in Ontario to see Spruce Grouse and many people have admired the flamboyant, April-May displays and "flutter-flights" of courting males not far from where you are standing. It could be argued, however, that Spruce Grouse do something even more spectacular than these exotic spring performances. Alone among living creatures, they succeed in extracting a living from the poor quality foliage found in those green deserts we call bogs.

Post 10 Agog at the Bog

For a fine view of the bog may we suggest that you climb up to the top of the rock cut . . .

From up here you can see the main features of the Sunday Creek bog: the meandering creek, the two broad mats covered with leatherleaf, and the army of Black Spruce on the far side. In the distance you see a pond created by beavers which, 7,400 years ago, set the stage for the bog in the first place, and whose continuing presence prevents the bog development from going on to completion.

Because each one of us lives for such a short time we often unconsciously assume that what we see in our lifetime has always been that way and always will be. One of the great points of interest about bogs is that they are quite incomprehensible unless we accept the idea of change. Slow change to be sure, but change nonetheless, which in its extreme form can bring about the transformation of lake into a forest. Seen in this context, the lives of the individual plants and animals which make up the bog community, the problems they face, and the solutions they have evolved — all take on a fascination few of us would have suspected before.

Algonquin Park is blessed with a great variety of widely different environments and natural communities of plants and animals. The spruce bog is just one of them. On the hills you see in the distance, for example, there is an entirely different natural community. Other trails, designed to introduce you to some of the other environments of Algonquin Park, are listed on the back cover of this guide.

Post 11

We hope you have found your walk interesting and have enjoyed learning something of spruce bog history and ecology.

If you do not intend to take this guide home with you, please put it in the box at this post so that others may use it later.

If you wish to keep the guide, please pay at the trail entrance sign if you have not already done so. Thank you.

OTHER ALGONQUIN TRAILS

This is just one of ten trails maintained in the Highway 60 region of Algonquin Provincial Park. Each is designed to introduce you to some specific aspect of the Park and each has a guide similar to this one. The nine other trails are listed below (distances are from the West Gate).

WHISKEY RAPIDS TRAIL (AT KM 7.2) This trail is a 2.1 km loop leading along the Oxtongue River to Whiskey Rapids. The trail guide discusses the ecology and history of an Algonquin river.

HARDWOOD LOOKOUT TRAIL (AT KM 13.8) This 0.8 km walk takes you through a typical Algonquin hardwood forest and culminates in a fine view of Smoke Lake and the surrounding maple hills. The guide offers some insight into the ecology of a hardwood forest.

MIZZY LAKE TRAIL (AT KM 15.4) This 11 km trail requires an early start and a full day to do properly. It visits nine ponds and small lakes and affords some of the best chances to see wildlife in the Parkway corridor.

PECK LAKE TRAIL (AT KM 19.2) The Peck Lake Trail is 1.9 km long and goes completely around the shoreline of Peck Lake before returning you to the parking lot. The trail guide explores the ecology of a typical Algonquin lake.

TWO RIVERS TRAIL (AT KM 31.0) The Two Rivers Trail is 2.1 km long, making an easy ascent to a pine-clad cliff overlooking the north branch of the Madawaska River. The guide examines the importance of change in the natural and present day Algonquin Forests.

HEMLOCK BLUFF TRAIL (AT KM 27.2) This loop trail, 3.5 km long through mixed hardwood and coniferous forest, leads to an impressive view of Jack Lake. The trail guide discusses the importance of Algonquin Park as a living laboratory for research in a variety of different fields.

LOOKOUT TRAIL (AT KM 39.7) This 1.9 km loop is a fairly steep and rugged trail which rewards the hiker with a magnificent view of several hundred square kilometres of Algonquin. The trail guide discusses the geology of the Park.

BOOTH'S ROCK TRAIL (SOUTH FROM KM 40.3) This 5.1 km loop trail starts one km south of the Rock Lake Campground office (8 km south of Highway 60). The trail skirts two small lakes, climbs to a spectacular lookout, and returns via the ruins of an old estate and an abandoned railroad. The trail guide explores the theme of man's impact on Algonquin.

BEAVER POND TRAIL (AT KM 45.2) A winding trail of 2.0 km through rugged hilly country yields close-up views of two beaver ponds, including a fine, bird's eye view from a rocky bluff. The trail guide provides an introduction to Algonquin's fascinating beaver pond ecology.

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ISBN 0-921709-26-9

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